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The total electron content (TEC) data taken during the period 7-14 November 1977 at Narssaq Point, Greenland using the ATS-5 satellite are presented and reviewed. During this time period a number of substorms were recorded on the local magnetometer, and the substorm effects on the TEC data are described. This is the terminal report on the satellite project at Narssaq Point.

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Introduction

This is the termination of the collection of satellite data at Narssarssuaq and Narssaq Point, Greenland. The recorded Faraday-rotation of geostationary satellites, mainly ATS-3, has been scaled and converted to total electron content (TEC) values at the Danish Meteorological Institute. The 15 minute values of TEC based upon ATS-3 records have been computed starting with April 20, 1972 and terminating with September 10, 1976. These data are available to users through the World Data Center.

The scaling was terminated in September, 1976 because ATS-3 started a rapid westward drift at this time.

From July till December 1977, when the station at Narssaq Point was closed, ATS-5 has been recorded for Faraday-rotation. These data have only been scaled for the short period, November 7-14. This period was chosen, because an AFGL-airplane equipped for ionospheric and auroral studies made three flights on Nov. 7, 9 and 13. The purpose of this mission was partly to study the equatorward termination of the evening auroral oval. The discussion of this small portion of data will illustrate the purpose to which the large ATS-3 database may be used However the difficulties and limitations in using this kind of data will also be stressed.

ATS-5 TEC-data November 7-14, 1977.

In November 1977 ATS-5 was positioned at 70° west longitude. ATS-3 was at approximately the same longitude untill September 1976. Figure 1 is a geographic map showing the line of sight to ATS-5 from the recording station at Narssaq Point (NP). Narssaq Point is 44 km southwest of the magnetic observatory at Narssarssuaq (NA). The 100-500 km altitude levels along the line of sight are marked. The stipled line is the projection along the earth's magnetic field lines to a datum surface at 100 km's altitude. The 65° invariant latitude circle (INV) also refers to the 100 km level.

The electron densities (el/m^3) along the line of sight up to the 500 km level contribute with approximately the same weight to the integrated Faraday-rotation. It means, that variations in the rotation may be either due to changes of E-region densities slightly south of Greenland or to changes in F-region densities far south of Greenland close to the invariant latitude of Goose Bay (GB).

The upper curve in Figure 2 shows the computed TEC-values converted to an equivalent vertical electron content. The baseline below the TEC-curve is the zero-level. The vertical lines indicate 00 UT.

There is an ambiguity in the scaled Faraday-rotation of an integral number of half turns (pi's). When the Faraday-rotation has been recorded for a substantial period of time without interruptions this integral number may be determined with great confidence. The period Nov. 7, 00 UT - Nov. 13, 1045 UT is such an example. However on Nov. 13, 14 there are several interruptions and gaps in the Faraday-rotation. These are due to ionospheric scintillation which deteriorates the Faraday-rotation. The start of each continous piece is marked by a small vertical tick below the base line. The number of pi's to be added to the Faraday-rotation are not known for these short periods, and therefore the absolute level of TEC should not be used for any analysis. This is an example of the most severe limitation to the use of the TEC data. It is especially disappointing because it occurs in connection with the high magnetic activity.

Geophysical discussion of Nov. 7-14

The middle curve in Figure 2 shows the magnetic field H-component recorded at Narssarssuaq (NA). The horizontal line marked by a zero, to the right shows the approximate quiet level, and the line below shows the -100 nT (gamma) level. The H-component as well as the Kp-values plotted at the bottom show, that Nov. 7, 8, 9[illegible] are quiet days (Kp<3), and the last half of Nov. 10 and Nov. 12, 13 and 14 a[illegible]turbed periods.

The TEC values behave in a way which is typical for winter time and in agreement with previous analyses of the ATS-3 data. The substorm activity is seen as negative bays in the H-component around corrected geomagnetic midnight (02 UT) and as positive bays in local afternoon and evening. The night time enhancements in TEC on Nov. 7, 12, 13 and 14 are due to ionization created by auroral particles. On Nov. 8, 9 and 11 the auroral electron precipitation does not migrate far enough equatorward to reach the line of sight to ATS-5 (Figure 1) or is too weak to create an observable ionization.

The high daytime TEC values on Nov. 10 are also typical. They occur, when a quiet period is followed by an onset of magnetic activity during local daytime. Finally during prolonged disturbed periods the winter day time values are close to or slightly below the quiet levels. This can be seen on Nov. 12. Because the absolute levels are not known on Nov. 13 and 14 the daytime values on these days can not be commented.

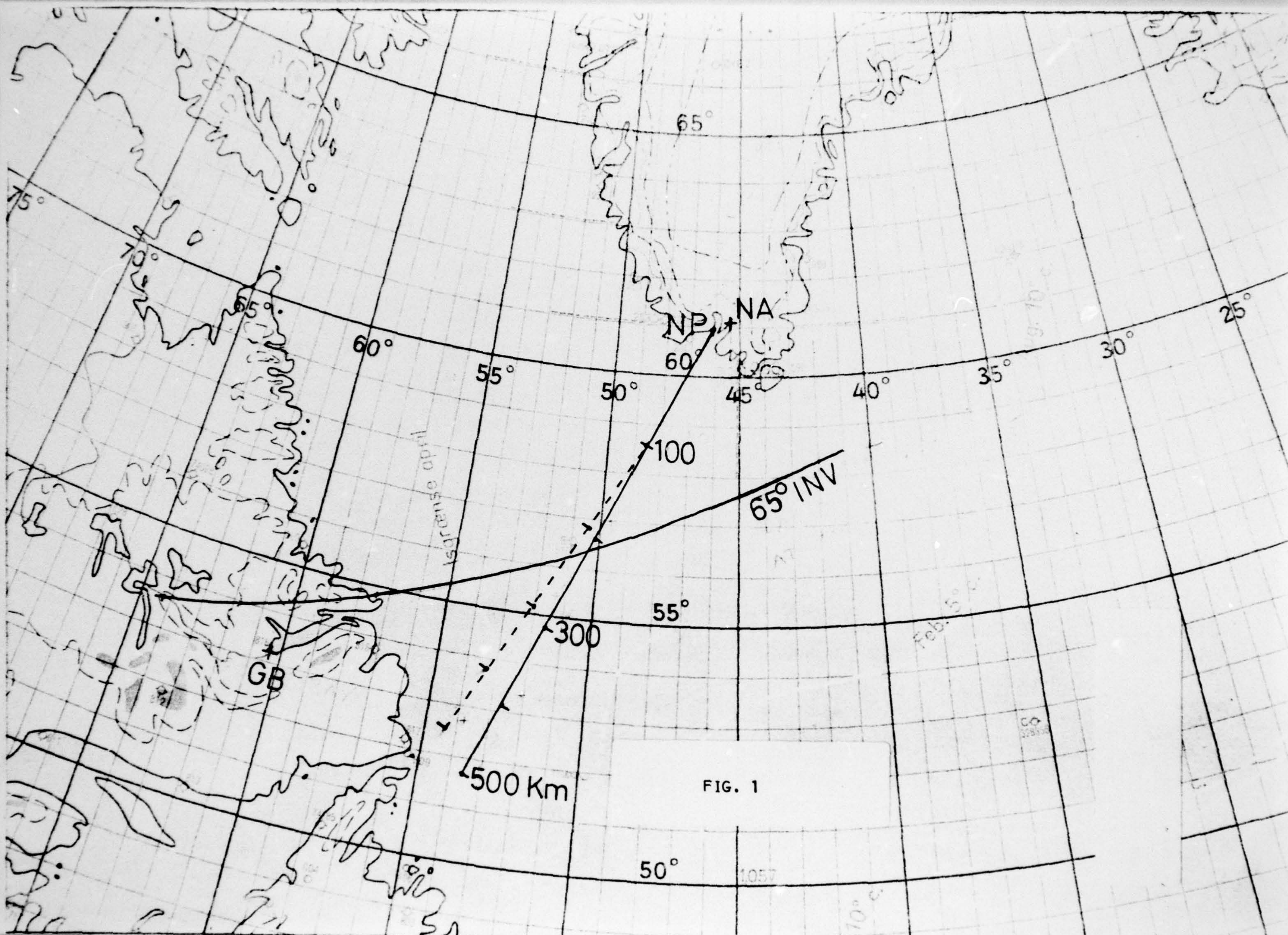
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FIG. 1

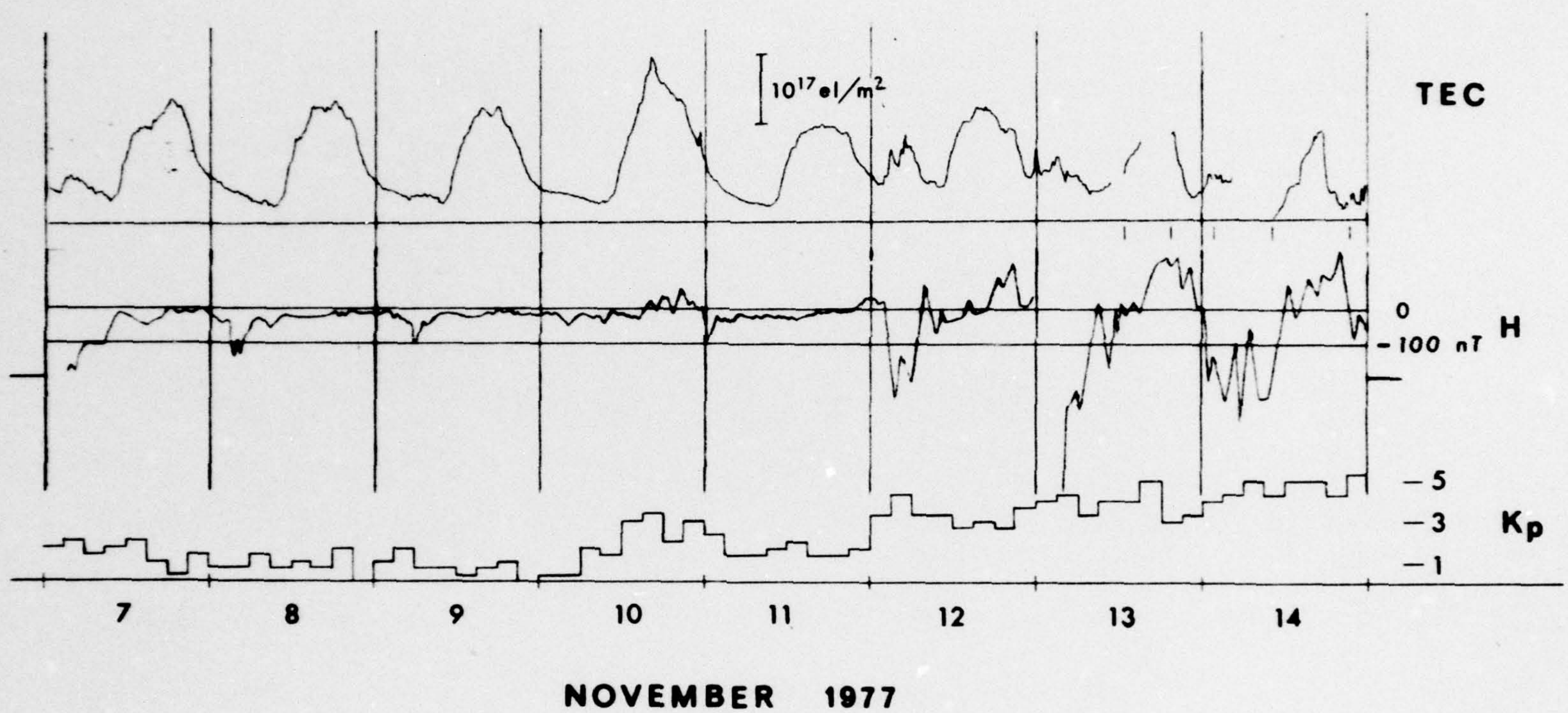

FIG. 2